PLANT PATHOLOGY
STUDIES ON PLANT DISEASE CONTROL, TOBACCO DISEASES

Harvey W. Spurr, Jr.

Research Plant Pathologist and Professor of Plant Pathology

Agricultural Research Service, USDA
in cooperation with N.C. State University
State 05468

I. Summary of Research:

This project is concerned with disease control mechanisms and their application to achieve plant disease control in a practical and economical manner. The emphasis is on new approaches and new techniques for understanding and efficiently controlling diseases. Specific objectives of immediate importance are: determine how to use leaf microflora to control foliar disease, determine how to induce resistance to disease and its practical application, determine how nematodes survive during periods of stress, dormancy and anhydrobiosis.

Research during 1983 was highlighted by the results described in the following paragraphs.

Tobacco blue mold: Two 1979 isolates (OPT1, KPT1) and one 1964 isolate (BPT1) of the pathogen Peronospora tabacina were studied to determine if a new race caused the 1979 North American epidemic. It was concluded that OPT1 and BPT1 are races of P. tabacina because they differed in symptom induction, virulence, germ tube growth and oospore morphology. Sporulation of P. tabacina measured 48 hr after soil drench application of metalaxyl to infected tobacco plants was decreased to 5% of untreated plants. Sporangiophore development was incomplete and sporangial morphology was abnormal on treated plants. Ultrastructural changes in the fungus were evidence 24 hr after treatment. Haustorial mother cells and haustoria were highly vacuolated or necrotic and nuclei were condensed. In infected, untreated plants 94% of the haustoria were encased by a single layer of amorphous, moderately electrondense apposition material; 6% were encased in two layers of apposition material. In infected, metalaxyl treated plants 25% of the haustoria were encased in bilayered appositions. (Cooperators: Gerald Van Dyke, Robert Trigiano)

Biological control of plant pathogens: Different species of nonpathogenic bacteria were obtained from foliage, soil and other habitats. These bacterial isolates were tested for antagonistic activity to fungal pathogens which cause foliar disease such as peanut leafspots (Cercospora arachidicola and Cercosporidium personatum). Bacillus thuringiensis and Pseudomonas cepacia were selected and identified for their potential to control foliar pathogens. They completely controlled pathogenic fungi in laboratory tests and provided up to 70% disease control in small-scale field tests. Formulated bacteria sprayed on peanut foliage using a 14-day schedule provided significantly more control than unformulated bacteria. Formulation ingredients such as sugar can increase disease and

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detergent can decrease disease thus altering the efficacy of biological control bacteria. Larger-scale field tests for peanut leafspot control were made in North Carolina during 1981 and 1982. A formulation of B. thuringiensis gave 74% control of leafspot and a significant increase in peanut yield. These results demonstrate the future potential of this disease control strategy. (Cooperator: Jack Bailey)

II. Graduate Students: None

III. Postdoctoral Fellows: Dr. Guy R. Knudsen, ARS-USDA Research Associate, Biological Control of Foliar Pathogens

IV. Publications:

Trigiano, R. N., C. G. Van Dyke, and H. W. Spurr, Jr. 1983. Blue mold: the development of the pathogen. Pages 6-13 in: Blue Mold Symposium III. Report: 30th Tobacco Workers Conference, Williamsburg, VA., Jan. 10-13, 1983.

Spurr, H. W., Jr. 1983. Delineation of races of the blue-mold pathogen. Pages 28-31 in: Blue Mold Symposium III. Report: 30th Tobacco Workers Conference, Williamsburg, VA., Jan. 10-13, 1983.

Trigiano, R. N., C. G. Van Dyke, and H. W. Spurr, Jr. 1983. Effects of metalaxyl on ultrastructure and sporulation of Peronospora tabacina infecting tobacco. (Abstr.). Phytopathology 73:969.

Trigiano, R. N., C. G. Van Dyke, H. W. Spurr, Jr., and D. J. Gray. 1983. Infection and colonization of tobacco callus cells by Peronospora tabacina. (Abstr.). Phytopathology 73:969.

Trigiano, R. N., C. G. Van Dyke, and H. W. Spurr, Jr. 1983. Haustoria development of Peronospora tabacina infecting Nicotiana tabacum. Can. J. Botany. 70:Dec.

Spurr, Harvey and Jack Bailey. 1983. Biological Control of Peanut Leafspot. (Abstr.). Proceedings 15th Ann. Meeting, Am. Peanut Research and Edu. Soc., Inc.

V. Manuscripts Accepted for Publication:

Trigiano, R. N., C. G. Van Dyke, H. W. Spurr, Jr., and D. J. Gray. 1984. Infection and colonization of tobacco callus by Peronospora tabacina. Phytopathology 84: (in press).

Spurr, H. W., Jr., G. V. Gooding, and F. A. Todd. 1984. An investigation of metalaxyl soil treatments for blue mold control on the incidence and development of TMV and Granville wilt. Tobacco Science: (in press).

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VI. Manuscripts in Review:

Spurr, H. W., Jr. 1984. Bioassays - critical to biocontrol of plant disease. J. Agric. Entomol. 1

Spurr, H. W., Jr. 1984. Mode of action of nematicides. In An Advanced Treatise on Meloidogyne, vol. 1, J. N. Sasser. ed.

VII. Papers Presented at Professional Meetings: See publications above.

VIII. Graduate Student Thesis Completed During Reporting Period:

Trigiano, Robert N. 1983. Ultrastructure and histology of Peronospora tabacina infecting tobacco.

IX. Acknowledgements:

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NC 03791 EPIDEMIOLOGY AND CONTROL OF FOLIAR DISEASES OF TOBACCO
Project Leader: C. E. Main

I. Summary of Research

Blue mold of tobacco is a foliar disease that is spread over long distances by microscopic, airborne spores during the spring and early summer of the growing season. The pathogen, Peronospora tabacina Adam, is an obligate, fungal parasite which survives and reproduces only on tobacco and Nicotiana spp. Under favorable weather conditions the resulting epidemics can be "explosure" resulting in major crop loss. Table 1 shows the impact of blue mold during the 1979 epidemic and succeeding years in North Carolina. Although losses have decreased due to current control strategies, this disease remains a continuing threat to tobacco production in North Carolina and the southeast.

Table 1: Losses to blue mold in North Carolina[a/]

	Flue-cured		Burley	
Year	Plant bed	Field	Field	% Reduction
1979	--	$38,400,000	$8,480,000	39.6
1980	$3,763,000	22,575,000	576,000	1.8
1981	240,000	242,000	1,165,000	1.9
1982	--	--	1,086,000	1.8
1983	185,000	555,000	400,000	<1.0

a/ Estimates compiled by the flue-cured and burley extension specialists.

Objectives

1. Monitor occurrence, distribution and importance of foliar diseases of tobacco in North Carolina.

2. Determine the source(s) of primary inoculum of Peronospora tabacina.

3. Develop improved control tactics for foliar diseases using fungicides, resistant cultivars and cultural practices.

4. Monitor the presence of ecotypes, strains and races of foliar pathogens.

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5. Relate development and spread of foliar diseases to weather and climate.

6. Assess the impact of foliar disease on yield and value.

7. Establish cooperative efforts on foliar diseases with state, federal and international research centers.

Recuring epidemics of blue mold have occurred in North Carolina since the major outbreak in 1979. Due to the potential seriousness of this disease, should pathogen resistance to the fungicide metalaxyl develop in the US, research has concentrated on the epidemiology and control of the disease and the biology of the pathogen.

Biology and Epidemiology

Prior to 1979 the disease was considered a plant bed problem favored by cool, wet spring seasons. The fungus was reported to be killed at >30°C which effectively constrained the disease from developing in the field during the summer months. The recent field epidemics raise the possibility that the pathogen has changed to a more temperature tolerant biotype than previously known in the US thereby enabling the disease to recur, survive longer during the season and cause crop losses each year.

Two approaches to the question of temperature tolerance are being pursued. The first involves a direct comparison, under controlled conditions in the NCSU-SEPEL Phytotron, of four isolates of P. tabacina collected in 1964 (BPT), 1979 (OPT), 1980 (CL80) and 1983 (NH). Results to date indicate that all the isolates survive, sporulate and germinate at temperatures as high as 36°C. Additional isolates of P. tabacina are being collected to monitor the changes taking place and to permit a more comprehensive pathogen population study in the future. A second, more indirect approach involves a cartographic study of impact (crop loss) in 10 southeastern states under the assumption that only the wild type (<30C) existed vs the assumption that the wild type co-existed with a temperature tolerant biotype. Using NOAA first order weather station data and ASCS county tobacco yield and value data for 1980, a computer cartography technique was developed to map crop loss estimates within temperature isotherm boundaries across the 10 states under both assumptions. Although other environmental variables are being considered, the most plausible explanation to account for the losses actually reported in 1980 is that the pathogen indeed did survive high summer temperatures. If the pathogen does survive and develop in the field at these temperatures, as it now appears that it does, then the traditional control strategies developed for the former

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biotype may need to be reevaluated.

Another type of study on blue mold involved a detailed meteorological analysis of the spread and development of disease within North Carolina during the 1980 epidemic. Dates of first reported occurrence of blue mold by county units in eastern North Carolina progressed in a northeastward direction from the South Carolina border to the Virginia border between 1 May and 6 June. In the central piedmont region of the state, blue mold was first reported in mid-May while in the western mountains, blue mold was recorded in early June. Data on temperatures and total weekly rainfall data were analyzed for 18 weeks from late March to early August from 102 weather stations across North Carolina and from the bordering regions of surrounding states. An analysis of first occurrence dates and the temporal and spatial properties of temperature and precipitation indicated once again that the epidemic continued to spread despite temperatures outside the range previously considered favorable for the disease. Availability of moisture on the tobacoc leaves for spore germination appeared to be the predominant factor in all parts of the state.

The question of source of primary inoculum of P. tabacina was studied. Meteorological trajectory analysis was used to identify possible source regions for the spores which arrived over North Carolina tobacco fields and initiated disease. The analysis indicated that there were many days in April, May and June 1980 when conditions were considered favorable for spore transport to North Carolina from the infected fields located to the south, particularly Florida and Georgia. Taking into account epidemiological latent periods and favorable weather conditions for sporulation and infection, certain of these trajectory dates were selected as representing the most probably periods of spore transport. Trajectory analysis provides an excellent tool for studying past epidemics and shows promise as a valuable component of future forecasting system.

Evaluation of Breeding Material

In 1982 a program was initiated in Crop Science and Plant Pathology to study genetic mechanisms of blue mold resistance in Australian and European cultivars and to develop agronomically improved, blue mold resistant burley and flue-cured breeding lines. Preliminary tests conducted in a winter nursery at Gurabo, Puerto Rico during 1982-83 indicated that the Australian cultivars Ovens 62, Sirone and Sirogo were the most resistant genotypes in the planting. The most susceptible cultivars were those resistant to Potato Virus Y (PVY). In 1983-84, 400 dihaploid lines were evaluated in Puerto Rico for blue mold resistance and agronomic characteristics. Some of the entries appeared to be as resistant as the resistant parents as well as possessing superior agronomic

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characters. Although blue mold development was relatively low in 1983-84, further analysis of the data may permit selection of superior material for further testing. Highly susceptible material and those with very poor characteristics can certainly be eliminated. The winter nursery represents a time saving facility since two tests can be conducted each year. In 1983 the severe drought and lack of blue mold development precluded evaluation in North Carolina. The nursery in Puerto Rico provided the first opportunity for extensive testing of the breeding lines generated in this program.

Fungicide Evaluation

Because of the concern that resistance to the fungicide metalaxyl might occur and become widespread in the US, evaluation of alternative fungicides was deemed a high priority objective. Selected fungicides were screened by P. B. shoemaker in the greenhouse for protectant, systemic or eradicant activity. Field testing was conducted in the North Carolina burley tobacco region and in a winter nursery in Puerto Rico. Two years of results have shown that most available protectant fungicides alone are inadequate to control blue mold under the heavy disease pressure in the tropical environment in Puerto Rico. In North Carolina, Shoemaker compared nine treatments applied approx. every 5 days and an unsprayed check in a field trial conducted at the Mountain Research Station. Judged most effective against blue mold were two formulations of mancozeb, including an 80WP and 70DG (dispersable granule) and Polyram 80WP. Providing fair control were Bravo 500, Difolatan 80WP and Agri-Strep. Judged poor were Phaltan 50WP and tribasic copper sulfate. This and the previous year's test supports our state recommendations for the use of mancozeb as a protectant fungicide for blue mold (presently, the only alternative to metalaxyl). Also, based on these tests, streptomycin sulfate has been removed from the recommendations for blue mold control.

During 1982-83 in Puerto Rico the systemic fungicides Ridomil 25WP spray, Ridomil 25WP layby and Ridomil 25WP plus Dithane M-45 80WP combination spray gave the best control. Galben 25WP spray and Vinicur 20WP spray gave fair control. in 1983-84 Ridomil 2E ppi at 1 qt/acre gave fair control while Ridomil 2E at both 1 and 2 qt/acre followed by SI layby treatments of 1 qt/acre gave excellent control. Other systemic materials showing promise were Galben 2E plus Dithane M-45 spray, SAN 518 64WP spray, and the experimental M-12279 2E spray.

In North Carolina, Shoemaker evaluated seven different rates of metalaxyl and two experimental fungicides as ppi and layby soil-applied systemics for control of P. tabacina. Where metalaxyl was applied as a ppi treatment up to 1.0 lb a.i.a., disease began to appear by 10 weeks after soil application.

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However, a split application of metalaxyl at ppi and layby at 0.5 lb a.i.a. at each application resulted in no detectable disease after 10 weeks. SAN 371 and Vinicur 20WP applied as ppi and layby treatments were less effective than metalaxyl at equivalent rates, but displayed significant systemic activity.

In addition Shoemaker tested twelve fungicide treatments and an unsprayed check in a test to evaluate foliar application of systemic fungicides. Treatments were applied on a 14-day schedule. Ridomil 2E, Ridomil MZ-58 and SAN 518 gave absolute control through August 22. Blue mold was detected, although at very low levels, in treatments sprayed with Galben, an experimental (M-12279), Galben plus mancozeb, and Vinicur M-SC. Judged ineffective was a Shell experimental, SD 87353. These tests provide data on possible alternative systemic fungicides to metalaxyl which may be foliar applied.

Residue Analysis

In field tests conducted in 1980, residues of metalaxyl in cured leaf increased with application rate and were lower in Burley than in flue-cured samples. Residues were lowest when metalaxyl was applied in the transplant water or once to the foliage in mid-season at a rate of 0.28 kg/ha. The greatest residue of 7.5 ppm was in a sample harvested 2 days after the second foliar application.

In a 1981 test, there appeared to be little difference in residue levels in green leaf tissue attributable to rate of application of metalaxyl. Residues decreased with time after application and with increasing sampling height on the stalk. On July 16, the last sampling date, metalaxyl was present in all samplings of bottom, middle, and upper leaves; but samples from plants treated closest to harvest contained highest residues.

In a 1982 test, residues in green leaf were higher for layby applications than for pre-plant incorporated application of the same rate of metalaxyl. The level in top leaves from 2.3 liters/ha (Ridomil formulation) applied before transplanting was <0.1 ppm, whereas the average level for top leaves from the layby treatment at the same rate was 2.5 ppm.

It is important to note that only the parent compound (metalaxyl) is measured by the analytical method used for experiments conducted in 1980 through 1982. Significant levels of a metabolite of metalaxyl are known to form in tobacco plants, and a total residue method is now being evaluated for use on 1983 experimental samples.

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II. Graduate Students: Michael A. Moss

Epidemiology of the blue mold disease of tobacco caused by Peronospora tabacina.

III. Postdoctoral Fellows: None

IV. Publications:

Jacobi, W. R., Main, C. E., and Powell, N. T. 1983. Influence of temperature and rainfall on the development of tobacco black shank. Phytopathology 73:139-143.

Johnson, C. S., Main, C. E., and Gooding, G. V. 1983. Crop loss assessment for flue-cured tobacco cultivars infected with tobacco mosaic virus. Plant Disease 67:881-885.

Johnson, C. S., and Main, C. E. 1983. Yield/quality trade-offs of tobacco mosaic virus-resistant tobacco cultivars in relation to disease management. Plant Disease 67:886-890.

Kirby, H. W., Main, C. E., and Carlson, G. A. 1983. Biological and economic factors influencing farmer acceptance of pest management practices. Plant Disease 67:1095-1099.

Kirby, H. W., Main, C. E., and Carlson, G. A. 1983. Economics analysis of managing multiple pests in tobacco. Plant Disease 67:1099-1102.

Main, C. E. 1983. Nature of Crop Losses: An Overview. In Challenging Problems in Plant Healt. Am. Phytopath. Soc. pp. 61-68.

V. Manuscripts Accepted for Publication:

Davis, J. M., and C. E. Main. A regional analysis of the meteorological aspects of the spread and development of blue mold of tobacco. Boundry-Layer Meteorology. (In press).

Campbell, C. L., W. R. Jacobi, N. T. Powell, and C. E. Main. Analysis of disease progression and the randoness of occurrence of infected plants during tobacco black shank epidemics. Phytopathology. (In press).

Main, C. E., and Proctor, C. H. Survey methods for tobacco diseases. Plant Disease (accepted).

VI. Manuscripts in Review: None

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VII. Papers Presented at Professional Meetings:

Moss, M. A., and C. E. Main. 1984. Application of computer cartography to estimate the impact of temperature tolerance in Peronospora tabacina on tobacco production in the southeast. (Abstr.) Phytopathology, Volume 74. (In press). Paper presented at the Southern Division, American Phytopathological Society, Nashville, TN, February 6-9, 1984.

Main, C. E. Cooperative blue mold research program between N. C. State University and the University of Kentucky - a proposal. Tobacco Workers' Conference, Williamsburg, VA, January 10-13, 1983.

VIII. Graduate Student Theses Completed During Reporting Period:

None

IX. Acknowledgements:

The blue mold research program at North Carolina State University is broad and complex involving many scientists. It is a team effort. It is my privilege to serve as coordinator of the blue mold research program and intereact with scientists from other departments, states and agencies concerned with this important disease. Special thanks are given to J. M. Davis (Meteorology), J. Kuc and William Nesmith (University of Kentucky), N. T. Powell and P. B. Shoemaker (extension tobacco pathology), Rebeca Rufty and Earl Wernsman (Crop Science), H. W. Spurr, Jr. (USDA, Oxford), and T. J. Sheets (Pesticide Residue Research Laboratory).

A special thanks is offered to Jerry Shiffert and Arnold Mitchem and to the R. J. Reynolds Tobacco Company for the support and encouragement provided to the blue mold research program in 1983.

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NC 05507 DISEASE CONTROL STRATEGIES FOR BURLEY TOBACCO AND VEGETABLES IN WESTERN NORTH CAROLINA

P. B. Shoemaker, Project Leader

I. Summary of Research:

The primary objective of this project during the past year has been to evaluate alternative fungicides and strategies to the use of metalaxyl (Ridomil) in the control of blue mold (Peronospora tabacina) on burley tobacco. The following studies have been undertaken:

A. Greenhouse fungicide screening for tobacco blue mold. Testing for protectant, systemic, and curative activity among approximately 25 fungicidal formulations were completed in 1983. Screening was begun in spring 1982 and continued through summer 1983, involving 18 different tests. Protectant activity was determined by applying fungicides to foliage one day before inoculating with P. tabacina and checking for blue mold development 10 days later. Of 20 treatments tested, 14 gave complete control of blue mold with at least one of three rates tested. Systemic activity was determined by applying fungicides to soil of potted tobacco plants, inoculating one week later, and checking for blue mold 10 days after inoculation. Materials with systemic activity against blue mold included metalaxyl (the standard), benalaxyl, Vinicur and SAN 504. Curative activity was determined by inoculating plants with P. tabacina, followed by fungicidal foliar sprays two days later. In many cases, lesions were visible after 10 days. However, a material was judged effective if it prevented sporulation. Materials that provided curative activity included: metalaxyl (the standard), benalaxyl, Vinicur and SAN 371. These greenhouse tests have aided in screening materials prior to field testing.

B. Field protectant fungicide evaluation for blue mold. Nine treatments applied approx. every 5 days and an unsprayed check were compared in a field trial conducted at the Mountain Research Station. Judged most effective against blue mold were two formulations of mancozeb, including an 80WP and 70DG (dispersable granule) and Polyram 80WP. Providing fair control were Bravo 500, Difolatan 80WP and Agri-Strep. Judged poor were Phaltan 50WP and tribasic copper sulfate. This and the previous year's test supports our state recommendations for the use of mancozeb as a protectant fungicide for blue mold (presently, the only alternative to metalaxyl). Also, based on these tests, we have removed streptomycin sulfate from the recommendations for blue mold.

C. Soil applied systemic fungicide evaluation for blue mold. Seven different rates of metalaxyl and two experimental fungicides were evaluated as ppi and layby soil-applied systemics for control of P. tabacina. Where metalaxyl was applied as a ppi treatment up to 1.0 lb a.i.a., disease began to appear by 10 weeks after soil application. However, a split application of metalaxyl at ppi and layby at 0.5 lb a.i.a each application resulted in no detectable

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disease after 10 weeks. SAN 371 and Vinicur 20WP applied as ppi + layby treatments were less effective than metalaxyl at equivalent rates, but displayed significant systemic activity.

D. Systemic fungicide spray evaluation for blue mold. Twelve fungicide treatments and an unsprayed check were compared in a test to evaluate foliar application of systemic fungicides. Treatments were applied on a 14-day schedule. Ridomil 2E, Ridomil MZ-58 and SAN 518 gave absolute control through August 22. Blue mold was detected, although at very low levels, in treatments sprayed with Galben, an experimental (M-12279), Galben plus mancozeb, and Vinicur M-SC. Judged ineffective was a Shell experimental, SD 87353. These tests provide data on possible alternative systemic fungicides to metalaxyl which may be foliar applied.

E. Influence of plant and row spacing and protectant fungicide spray interval on blue mold epidemics. Three plant by row spacings (14 X 42, 18 X 48, and 22 X 54 inches) and four fungicide spray intervals (0, 5, 7 and 10-day) were compared in a factorial experiment to determine their influence on blue mold development. Spacing had a significant effect on blue mold development in the unsprayed check plots, with the close (14 X 42 Inches) and the wide spacing (22 X 54 inches) averaging 88.1 and 43.9 lesions per plant, respectively. The four spray intervals averaged across the spacing treatments had 1, 5, 6 and 64 lesions per plant for the 5, 7, 10-day spray interval and check, respectively. Yields were significantly greater in the sprayed vs non-sprayed plots for the two close spacing spray treatments. These data indicate that blue mold can be significantly reduced by wider plant spacings and by protectant foliar fungicide sprays.

II. Publications:

Shoemaker, P. B. 1983. Fungicide evaluation for blue mold on burley tobacco. In Proceedings, Blue Mold Symposium III, (30th Tobacco Workers Conference, Lexington, KY, Jan. 10-13, 1983, Williamsburg, VA). pp 43-50.

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2. Mark Henry, Field Technician
3. Dreama Milks, Agricultural Research Technician
4. Hugh Russell, Tobacco Research Technician
5. D. F. Tugman, Superintendant, Upper Mountain Research Station

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NC 3643: CULTURAL AND NUTRITIONAL INVESTIGATIONS WITH FLUE-CURED TOBACCO

Department of Soil Science

G. S. Miner, Project Leader
M. J. Vepraskas, Cooperator

I. Summary of Research:

Effects of Tillage Method on Production of Flue-Cured Tobacco

Work was continued in 1983 to further quantify benefits to tobacco that may be expected from subsoiling soils in the coastal plain region of North Carolina. Previous work (1982-1983 annual report) resulted in the development of models relating yield increase for subsoiling over conventional tillage to various soil physical properties. These may be useful in predicting which sites might benefit from subsoiling.

A total of 9 field experiments (4 on-farm; 5 research station) were established to evaluate the effects of tillage on nutrient uptake and root distribution. Treatments consisted of conventional tillage, chisel-plowing to a depth of 11 inches, and subsoiling to the depth of the top of the B horizon. All treatments were replicated 4 or 5 times, depending on location, in a randomized complete block arrangement.

The effects of tillage on yield and grade index at 7 of the 9 locations is presented in Table 1. Drought and a severe hornworm infestation terminated an on-farm experiment while granville wilt devastated a research station experiment.

Significant differences in yield due to tillage treatments occurred at 5 of the 7 locations. Subsoiling gave the greatest yield increase compared to conventional tillage while the effects of chisel-plowing were intermediate to those of conventional and subsoil tillage. Cured-leaf quality, as measured by grade index, was relatively unchanged by tillage treatment (Table 1).

Significant differences in concentrations of reducing sugars and total alkaloids occurred in only one experiment (Table 2). Subsoiling increased concentration of reducing sugars and decreased concentration of total alkaloids at an on-farm test in Johnston County.

Three of the 7 experiments received supplemental irrigation and these gave the highest yields (Table 1; UCPRS, CCRS, CCRS). It is interesting that these 3 experiments also were among those giving the greatest relative yield increase to subsoiling compared to conventional tillage.

Green, whole-plant samples and cured leaves are presently being evaluated for content of N, P, K, Ca, Mg, S, Cl, Mn, Zn, Cu and Fe. Analyses have not been completed but results of tests conducted in 1982 indicate that subsoiling increased nutrient uptake by cured leaves at Clayton which

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also had a yield response (Table 3). A portion of the increased nutrient uptake can be attributed to an increase in yield or sink size. However, nutrient concentrations were increased by subsoiling at Clayton (not statistically evaluated) indicating that an additional quantity of nutrients was absorbed above that required to maintain concentration levels with an increase in sink size. An exception to this was P which tends to remain in the topsoil and subsoiling has little effect on additional recovery. Although subsoiling generally increased yield, Clayton was the only site with significant differences due to subsoiling. Models relating yield response from subsoiling to physical properties of the soil indicate that little response would be expected at the other 4 sites. Future work will be restricted to well-drained soils of the upper coastal plain where tillage-pans tend to occur.

Effect of S on Yield and Quality of Flue-Cured Tobacco at Clayton

A test was conducted at Clayton on Goldsboro and Bibb soil series to determine if there is a need for additional S at that location. This was done in association with Wallace Baker and Bo Wood to assist them in refining their fertilization program.

Rates of 0, 50, 100, 150, and 200 lb/A of K Mg SO_4 were replicated 8 times in a randomized complete block arrangement. They were imposed on the standard fertilization used at the station. Rates of K, Mg, and S varied among treatments but it was assumed that the K and Mg status of the soil, plus that from the complete fertilizer, was adequate for optimum growth. Any observed differences between treatments were assumed to be indicative of a response to S.

There were no significant differences in yield or grade index due to K Mg SO_4. There were significant differences in concentrations of total alkaloids and reducing sugars among treatments. However, alkaloid differences appeared rather random among treatments and were of little practical significance. Reducing sugars tended to decrease slightly with increasing rates of K Mg SO_4. Apparently, the high amount of rainfall received at Clayton early in the season did not leach S to depths below the root zone and there was no advantage from applying additional S in the soil.

Effect of Rate of N Application and Variety on Yield, Grade Index, and Maturity of Flue-Cured Tobacco.

To answer questions about N management of flue-cured varieties, a test was conducted at Clayton in association with Wallace Baker and Bo Wood to assess the interaction effects of 6 varieties and 3 N rates on production of flue-cured tobacco. Variety and N rate combinations (Table 5) were replicated 4 times in a split-plot arrangement with varieties in whole plots and N rates in subplots. Varieties were randomized properly within replications but N rates were stripped across replications to facilitate application. Assuming no gradient occurred at right angles to the direction of blocking, the sub-plot analysis would be appropriate. However, we have no estimate of that effect. For purposes of this pre-

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sentation, it is assumed that the experimental area was uniform and main effects of N were not biased by soil gradients.

The interaction between variety and N rates were not significant for either yield or grade index so only main effects are presented. The proportion of total harvested tobacco receiving immature, unripe, and ripe grades was determined but not subjected to statistical analysis. Management was the same across all treatments, including an additional application of 20 lb N/A to replace N assumed loss to leaching early in the season.

Lack of yield differences between the two lowest N rates and a depressed yield at the high N rate along with exceptionally high overall yield, suggest that all N rates were too high when the extra 20 lb N/A is included (Table 5). There were no significant differences in grade index among N rates and no apparent differences in distribution among maturity groups. About 60 to 70% of the cured leaf was less than ripe among the N treatments.

Varieties are listed in the order of decreasing yield and three varieties had significantly higher yields than the two lowest-yielding varieties. Grade index was significantly lower for high-yielding varieties than for low-yielding varieties and it appears to be related to the proportion of total leaf that was immature. The highest grade indices were associated with varieties having practically no immature tobacco while lower indices were associated with varieties having 6 to 12% of the tobacco grading immature. With the exception of McN 373 all varieties had low percentages of ripe leaf which further supports the view that N rates were too high.

II. Graduate Students: One M.S. Candidate
One M. S. Candidate co-chaired with Dr. Raper
One Ph.D. Candidate co-chaired with Dr. Nicholaides
One Ph.D. Candidate co-chaired with Dr. Peedin

III. Post-doctoral Fellows: None

IV. Publications:

Miner, G.S., J.S. Cundiff, and J.D. Miles. 1983. Effects of clipping flue-cured tobacco plantbeds on transplant uniformity and production efficiency. Tob. Sci. 27:70-74.

Miner, G.S., J.S. Cundiff, and J.D. Miles. 1983. Effects of clipping flue-cured tobacco plantbeds on field performance of clipped plants. Tob. Sci. 27:75-76.

Miner, G.S. and J.L. Sims. 1983. Changing fertilization practices and utilization of added plant nutrients for efficient production of burley and flue-cured tobacco. In L.P. Bush (ed.) Production of quality tobacco lines. Recent Advances in Tobacco Science. 9:4-76.

2000587095

Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Miner, G.S. and R.I. Azabi. 1983. Leaching of nutrients from fertilizer lands. Soil Sci. Soc. of N.C. Proceedings pg. 21-32.

V. Manuscripts Accepted for Publication: None

VI. Manuscripts in Review:

Sene, M., M.J. Vepraskas, G.S. Miner, and G.F. Peedin. Relationships among relative tobacco yield increase to subsoiling and soil physical properties. Submitted to Agron. J.

VII. Papers Presented at Professional Meetings:

Peedin, G.F., G.S. Miner and M.R. Tucker. Effects of subsoiling on agronomic and chemical characteristics of flue-cured tobacco 30th Tobacco Workers Conference, Jan. 10-13, 1983. Williamsburg, VA.

Miner, G.S. and J.L. Sims. Changing fertilization practices and utilization of added plant nutrients for efficient production of burley and flue-cured tobacco. Invitational paper at 37th Tobacco Chemists' Research Conference, Oct. 11-13, 1983. Washington, D.C.

VIII. Graduate Student Theses Completed During Reporting Period:

Galindez, Antonio. Response of flue-cured tobacco to Mn fertilization on overlimed soils.

2005870960

Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 1. Effect of tillage on yield and grade index of flue-cured tobacco at 7 sites in 1983.

Location[b]	Tillage Method				Soil Series
	Conventional	Chisel-Plow	Subsoil	LSD(0.05)	
			Yield (lb/A)		
BBTRS	2049	2045	2173	NS	Norfolk
UCPRS	3108	3373	3721	162	Norfolk
CCRS	2820	3052	3203	198	Wagram
CCRS	2561	2655	3034	324[a/]	Norfolk
Lenoir Co.	1433	1717	1771	169	Norfolk
Lenoir Co.	2049	2045	2173	NS	Norfolk
Johnston Co.	1661	1908	2031	292	Wagram
			Grade Index		
BBTRS	63.5	63.0	65.7	NS	
UCPRS	41.0	45.9	48.0	NS	
CCRS	48.5	49.1	49.4	NS	
CCRS	47.4	47.8	45.9	NS	
Lenoir Co.	60.6	60.8	59.0	NS	
Lenoir Co.	68.9	70.1	71.6	NS	
Johnston Co.	41.1	42.5	43.0	NS	

a/ Significant at 0.10 level of probability. L.S.D. expressed at that level of probability.

b/ BBTRS - Whiteville, UCPRS - Rocky Mount, CCRS - Clayton.

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 2. Effect of tillage on concentration of reducing sugars and total alkaloids in cured leaves of flue-cured tobacco at 7 sites in 1983.

Location	Tillage Method			
	Conventional	Chisel-Plow	Subsoil	L.S.D.(0.05)
		Reducing Sugars (%)		
BBTRS	18.0	17.4	17.7	NS
UCPRS	15.1	16.1	17.8	NS
CCRS	13.2	14.3	14.7	NS
CCRS	12.5	13.2	13.5	NS
Lenoir Co.	10.1	11.6	11.0	NS
Lenoir Co.	7.4	7.7	8.3	NS
Johnston Co.	7.7	10.4	10.3	1.9
		Total Alkaloids (%)		
BBTRS	2.47	2.53	2.46	NS
UCPRS	3.91	3.93	3.79	NS
CCRS	3.35	3.18	3.01	NS
CCRS	3.29	3.16	3.15	NS
Lenoir Co.	3.74	3.31	3.27	NS
Lenoir Co.	3.85	3.79	3.66	NS
Johnston Co.	3.54	3.45	2.75	0.59

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 3. Effect of tillage on nutrient uptake, yield and nutrient concentration of cured leaves at 5 locations in 1982.

Nutrient	BBTRS[a] NS	BBTRS[a] S[b]	LCPTRS NS	LCPTRS S	LCPTRS LSD(0.05)	CCRS NS	CCRS S	CCRS LSD(0.01)	OTRS NS	OTRS S	OTRS LSD(0.01)	UPRS NS	UPRS S
Nutrient Uptake (lb/A)													
N	65.5	64.3	50.0	55.9	NS	39.1	46.9	3.83	47.3	47.6	NS	76.7	81.4
P	5.2	5.2	4.8	5.5	0.6	6.7	6.4	NS	6.2	6.3	NS	4.9	5.2
K	65.2	64.9	58.0	66.3	7.0	36.2	45.7	3.24	56.4	65.8	5.0	65.9	70.8
Ca	55.0	54.4	41.9	38.1	NS	22.0	26.7	2.09	36.4	37.9	NS	60.5	63.1
Mg	13.1	13.1	11.6	12.2	NS	9.6	11.4	0.89	13.0	12.6	NS	13.6	13.5
S	9.9	9.8	9.2	9.7	NS	5.1	5.7	0.39	8.9	10.0	1.0	9.9	9.5
Yield	3378	3290	2690	2763		2300	2544		2848	2926		3305	3363
LSD(0.05)	NS		NS			153			NS			NS	
Nutrient Concentration(%)													
N	1.93	1.95	1.86	2.02		1.70	1.84		1.66	1.63		2.32	2.42
P	0.15	0.16	0.18	0.20		0.29	0.25		0.22	0.22		0.15	0.15
K	1.93	1.97	2.16	2.40		1.57	1.80		1.98	2.25		1.99	2.11
Ca	1.63	1.65	1.56	1.38		0.96	1.05		1.28	1.30		1.83	1.88
Mg	0.39	0.40	0.43	0.44		0.42	0.45		0.46	0.43		0.41	0.40
S	0.29	0.30	0.34	0.35		0.22	0.22		0.31	0.34		0.30	0.28

[a] BBTRS - Whiteville, LCPTRS - Kinston, CCRS - Clayton, OTRS - Oxford, UPRS - Reidsville

[b] NS - not subsoiled, S - subsoiled

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 4. Effect of rates of K Mg SO_4 on yield and quality of flue-cured tobacco at Clayton in 1983.

Rate of K Mg SO_4 Application	Yield	Grade Index	Total Alkaloids	Reducing Sugars
	lb/A		(%)	(%)
0	3147	55	2.88	15.2
50	3143	54	2.60	16.8
100	3189	55	2.52	16.1
150	3214	52	2.79	14.8
200	3285	56	2.96	14.5
LSD(0.05)	NS	NS	0.27	1.3

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 5. Main effects of rates of N application and variety on yield, grade index and leaf maturity at Clayton in 1983.

Variety	N [a] Rate	Yield	Grade Index	Grades		
				Immature	Unripe	Ripe
	(lb/A)	(lb/A)		%		
NC 1523	-	3359 a	50.2 ab	12.4	56.1	31.5
McN 944	-	3289 a	51.8 abc	6.3	68.3	25.4
NC 50	-	3289 a	48.6 a	10.1	75.4	14.5
NK 326	-	3243 ab	55.0 bcd	1.9	64.8	33.3
McN 373	-	3006 b	60.0 d	0.0	35.6	64.4
NC 82	-	2990 b	55.8 bcd	1.6	70.9	27.5
-	56	3236 a	53.3 a	6.1	65.6	28.3
-	64	3253 a	54.1 a	5.4	55.8	38.8
-	72	3098 b	53.3 a	4.6	64.2	31.2

[a] Due to high rainfall early in the season, N was presumed lost by leaching and an adjustment of 20 lb N/A was applied on all treatment (above rates listed).

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NC 03659 ENVIRONMENTAL DETERMINANTS OF

CROP GROWTH AND SOIL PRODUCTIVITY

C. D. Raper, Jr., Project Leader

I. Summary of Research:

As part of an ongoing research program, we have been investigating the interrelationship between root-zone environmental factors that affect nitrogen uptake by roots and carbon assimilation by shoots. Experiments completed in the past year have concentrated on root acclimation to low temperature stress and regulation of nitrogen uptake and utilization in whole plants.

A. Root Acclimation to Low Temperature Stress.

Two tobacco lines, 'Coker 139' parental line and its dihaploid 'Coker 139 DH7', are being used to investigate the physiological effects of temperature stress on nitrogen uptake and metabolism. Six-week old tobacco transplants of the parental line and its dihaploid were grown in a flowing hydroponic culture system at a common aerial temperature of 26/22 C (day/night) and root-zone temperatures of 24 and 14 C for a 26-day period. Nutrient solution was complete, with 1.0 mM NO_3^- as the sole source of nitrogen. Plants were periodically harvested to determine leaf number and area, and plant parts freeze-dried, weighed and prepared for nitrogen analysis. In addition root activity was monitored by ion chromatographic measurement of nitrate removal from the nutrient solution. The effects of low root-zone temperature on carbon exchange rates and growth were similar for the parental line and its dihaploid. In both lines photosynthetic rates of plants grown at a root-zone temperature of 14 C were 90 to 100% of the control values. However, in association with a reduction in nitrogen uptake at 14 C, leaf initiation and expansion were reduced, and leaf area and total dry weight were only 32 and 55%, respectively, of the control values after the 26-day exposure to low root-zone temperature. Partial acclimation of these root systems to low root-zone temperature was indicated by the continued, although reduced, leaf production, dry matter accumulation, and nitrogen uptake and assimilation in the plants. To assess the degree of physiological acclimation of root tissue in the two tobacco lines, fatty-acid composition and total lipid content of root tissue exposed to the two root-zone temperatues currently are being determined.

The reduction in nitrogen uptake and assimilation seen under low root-zone temperature may have been related to direct temperature effects on root activity or to temperature effects on bulk water and ion movement through the root via altered membrane permeability. To assess the contribution of these two effects, a temperature-controlled root pressure chamber is being used to examine uptake rate and translocation of NO_3^- through excised root systems. With this chamber, root systems can be exposed to a constant pressure and, by varying temperature, one can determine the effects of temperature on bulk flow rate and movement of nitrogen through the root. Conversely, decreases in water movement through root systems at cool temperatures can be offset by increasing pressure within the chamber. By maintaining a constant flux through

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excised root systems grown at the two temperatures, direct root-zone temperature effects on nitrate uptake, reduction and translocation rate in the roots can be examined.

In the first of two experiments, 6-week old transplants from the two tobacco lines were grown hydroponically as before for 3 weeks at root-zone temperatures of 24 and 14C. Over the course of the treatment period, excised root systems of these plants were placed in the root pressure chamber containing aerated nutrient solution equivalent to the growth chamber solution. Root systems were pressurized to a constant pressure of 2.5 bars, and then steady-state flow rates determined at 6 temperatures between 24 and 8 C. Exudate and solution samples were collected at each temperature and frozen for subsequent nitrogen analysis. At the conclusion of a temperature curve, the excised root systems were frozen, freeze-dried and prepared for nitrogen analysis. In a subsequent experiment, temperature will be held constant at 24 or 14 C and pressure in the chamber varied between 0.5 and 5 bars. Steady-state exudation rates will be determined for root systems from the two tobacco lines grown as before, and exudate and solution samples collected and frozen for further nitrogen analysis. Final data from these two experiments will be used to assess the relative contribution of these temperature-related effects in regulating nitrogen uptake and assimilation in roots grown at cool and warm root-zone temperatures.

B. Regulation of Nitrogen Uptake and Utilization: Nitrogen Source and Nitrogen Stress.

By altering the relative ability of tobacco plants to absorb and assimilate nitrogen from NO_3^- and NH_4^+ sources, environmental stresses may account for the poorer performance sometimes observed when field-grown tobacco is fertilized with NH_4^+. In one of a series of experiments, 6-wk old tobacco transplants (Coker 139) were grown hydroponically for 28 days in complete nutrient solutions containing NO_3^- or NH_4^+ as the nitrogen source. Solution pH was maintained at 6.0 or 4.0. Plants were sampled at 6 to 8 day intervals to determine treatment effects on leaf initiation, leaf area and number, dry matter production and nitrogen content of plant tissues. Tobacco plants grown under NO_3^- nutrition acclimated to low root-zone pH, and throughout the experiment had similar leaf area and number, photosynthetic rates and dry matter production at pH 4.0 and pH 6.0. In contrast, plants grown under NH_4^+ nutrition and solution pH 4.0 showed severe inhibition of photosynthesis and growth after 13 days exposure, followed by death. However, if solution pH was kept at 6.0, plants grown with $NH4^+$ nutrition maintained comparable photosynthetic rates and yielded similar total dry matter and leaf area and number as plants grown with NO_3^- nutrition at either solution pH. Tissue collected during this experiment is being analyzed for nitrogen to determine the extent to which effects of pH on root function during steady-state growth conditions altered the relative ability of tobacco plants to assimilate nitrogen from NO_3^- and NH_4^+ sources.

Previous research indicates that, at reduced levels of nitrogen in solution, plants have decreased nitrogen uptake by roots and decreased leaf expansion. Demand for carbon in the leaf sink declines and there is a shift in carbon partitioning from the leaves to the roots as a balance between root and

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shoot functioning is restored. In a follow-up experiment, 6-wk old tobacco transplants (Coker 139) were grown hydroponically for 8 days with 1.0 mM NO_3^- in a complete nutrient solution and then exposed to complete nutrient solution with 1.0 or 0.0 mM NO_3^- for 8 days. Nitrogen stress was then relieved by transferring half of the plants from the 0.0 mM NO_3^- solution back into a 1.0 mM NO_3^- solution for 21 days. The remainder were kept in the 0.0 mM NO_3^- solution. Over the 21-day recovery period, photosynthetic rate returned to a normal level and the balance between root and shoot growth was restored as production of new leaf area was renewed. Leaf tissue samples from this experiment will be analyzed to determine the minimum nitrogen concentration in the leaves necessary to support the reduced, but sustained, photosynthetic rates seen in plants continually exposed to nitrogen stress.

II. Publications:

Wann, M. and C. D. Raper, Jr. 1984. A dynamic model for plant growth: Validation study under changing temperatures. Ann. Bot. 53:45-52.

III. Graduate Students:

Celia L. Cannon (M.S.)
Tom C. Granato (Ph.D.)

IV. Postdoctoral Fellows:

Dr. Leslie C. Tolley

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

NC 03827 Cultural, Nutritional and Varietal Investigations
with Burley Tobacco
J. E. Shelton, Project Leader

I. Summary of Research:

Objectives of the project are:

A. To evaluate methods of distinguishing differences in P and K requirements of differing soils.

B. To correlate information from objective A with yield and quality of burley tobacco over a wide range of soil fertility and management.

C. To investigate urea as a N Source for burley.

D. To evaluate advanced breeding lines and commercial varieties of burley tobacco.

Management Studies:

Preliminary P sorption isotherms on five soil types utilized for burley tobacco production show a wide range in the phosphate requirement to establish a given soil solution P concentration. This information will serve as a basis for establishing greenhouse and field studies for the 1984 season.

Research conducted in 1983 to study the effect of fertilizer application on soils having very high soil test levels of P and K showed that highest yields and dollar value resulted from application of nitrogen only at 228 kg/ha.

In a fumigation X nitrogen source and rate using Vorlex, Vorlex plus plastic, Terr-O-Cide 30, and an untreated check with $Ca(NO_3)_2$, NH_4NO_3 and urea at 114, 228 and 456 kg/ha of nitrogen plant survival following transplanting was lower at the highest rate of nitrogen regardless of source and was significantly lower at the highest rate of urea with the Vorlex plus plastic treatment. However, plants were reset and there was no significant difference due to N source at the high N rate. At N rates of 114 kg N/ha yields from urea were significantly higher than from $Ca(NO_3)_2$ with NH_4NO_3 being intermediate and not significantly different from the other N sources. However, at the higher N rates there were no significant differences in yield due to N source regardless of the fumigation treatment. Nitrogen analyses of the cured leaf samples are incomplete. However, the total alkaloid contents were higher with the Vorlex plus plastic fumigation treatment. This was followed by the Terr-O-Cide 30 treatment and no difference in total alkaloids with Vorlex or the check. Total alkaloids were not affected by rate or source of nitrogen.

Vareity Evaluations:

Regional variety trials were conducted in accordance with guidelines established at the 27th Tobacco Workers Conference in 1977 as reviewed by the Burley Tobacco Qaulity Committee in 1983. Three types of variety trials

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were conducted in 1983; these being the small plot or preliminary test, farm test which included advanced breeding lines that have been approved by the committee as meeting the requirements of the small plot test the previous year, and commercial variety trials. The small plot and farm test are conducted at the Mountain Research Station while the commercial variety trials are conducted at the Mountain and Upper Mountain Research Stations.

The results for the small plot test showing plant characteristics, virus ratings and yield data are presented in Table 1.

The farm test entries in 1983 included 4 breeding lines and 2 standard varieties. The results are presented in Table 3 and yields are relatively low as compared to the small plot test because the small plot test was irrigated.

Although the commercial variety trials were conducted at the Mountain and Upper Mountain Research Stations only the results of the test conducted at the Mountain Research Station are presented in Table 3. Severe frost damage occurred at the Upper Mountain Station and the results appear to have little value. Kentucky 14 which is one of the frequently grown varieties in western North Carolina give yields and dollar returns equivalent to the hybrids and unless specific disease resistance is a requirement the use of the hybrids would not be justifiable.

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 1. Plant characteristics, virus ratings and yield data for entries in the 1982 Regional Burley "Small Plot" Test at the Mountain Research Station, Waynesville, NC

Code #	Breeder # or Variety	Ht-cm	L - W	# of Harvestable Leaves	Days 50% flower	Virus Rating %	Yield lbs/A
83 R-1	Coker 82-141E	120	66-34	21	63	31.3	1763
83 R-2	Ky 8136	131	66-36	22	83	16.8	2805
83 R-3	Gr. 108	150	64-35	22	76	23.1	2536
83 R-4	Coker 82-39-4E	125	63-30	21	74	26.7	1819
83 R-5	Gr. 110	141	63-32	23	74	16.7	2449
83 R-6	Coker 82-161-2E	143	65-31	21	70	28.8	1940
83 R-7	Gr. 109	145	67-32	23	73	15.6	2374
83 R-8	Rogers 82-166F	129	70-35	24	75	28.7	2623
83 R-9	Gr. 111	136	62-33	22	73	12.2	2486
83 R-10	Rogers 82-169F	127	66-31	21	66	23.2	2186
83 R-11	Coker 82-153-4E	115	66-33	21	66	25.8	1912
83 R-12	VA 505	164	66-35	25	72	15.2	2365
83 R-13	VA 510	142	75-38	23	76	15.2	3163
83 R-14	Rogers 81-58-3	125	68-33	22	74	24.3	2263
83 R-15	Rogers 81-62-1	134	70-34	20	75	21.3	2504
83 R-16	Ky 14	140	68-32	22	66	19.7	2617
83 R-17	Ky 80460	139	66-34	21	73	17.5	2659
83 R-18	VA 509	139	68-31	23	70	18.1	2630
83 R-19	Ky 80428	138	65-34	23	72	19.7	3059

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 2. Yield data for entries in the 1983 Regional Burley "Farm Test" Haywood Co.

Code #	Breeder # or Variety	Yield-lbs/A	$ Value
83 F-1	Ky 80428	1803	3350
83 F-2	Rogers 81-58-3	1615	2820
83 F-3	Ky 80460	1566	2883
83 F-4	Va 509	1532	2849
83 F-5	Rogers 81-62-1	1457	2544
83 F-6	Ky 14	1379	2569

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

Table 3. Yield data for varieties in the 1983 Commercial Variety Evaluation Test. Mountain Research Station. Waynesville, NC

Variety	Yield	$ Value/A
Ky 14	2673	4759
Ky 17	2590	4425
R 7-11	2555	4449
Bur. 21 X Ky 10	2537	4387
Va 509	2473	4386
Ky 14 X L 8	2468	4304
Ky 15	2468	4079
NC 141	2417	4274
NC 150	2316	4208
NC 139	2230	3804
NC 125	2154	3841
Va 528	2111	3602
NC 58	2049	3644
NC 71	2004	3403
Clay Hybrid 501	1917	3408
Coker 42	1858	3192
Burley 64	1801	3240
L.S.D.	498	886

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

State 3819 Cover Crops Evaluation and No-till Crop Production on Mountain Soils of North Carolina

G.D. Hoyt, Project Leader

I. Summary of Research

Main Objectives:

A. Develop no-till cultural practice for sloped mountain soils.

B. To identify cover crop residues that increase water infiltration, reduce soil water evaporation, and enhance yields.

A no-till burley tobacco management system was established in 1983 to develop cultural practices which would decrease erosion, increase water infiltration, retain soil moisture, and provide comparable yields to conventional tillage. This system utilizes a fall planted cover crop that is spring killed, strip tilled with a subsoiler-coulter combination and planted with regular transplant equipment. Cover crops were established in the fall of 1982. Previous summer crop residue and fertilizer P, K, and limestone were added at cover crop planting. Previous to spring burley planting, the various cover crops were sampled for biomass and then killed with glyphosate. Seven days later the subsoiler-coulter combination (Brown-Harden Ro-till) was ran through the field to establish the rows (160 cm). This equipment provides tillage for 6 to 10 inches of the soil surface. The various cover crops provided surface soil coverage that ranged from 0 (bare) to 66% (barley) (Figure 1). These covers also influenced the severity of transplant shock. Plots with no cover had a survival rate of 82%, where as plots with thick residues (barley & rye) had a survival rate greater than 97% (Figure 2). Mid season flowering was also influenced by the type of winter cover that was used. No-till tobacco with cover crop residue flowered earlier than cultivated, and much earlier than no-till tobacco with no winter cover (Figure 3).

Yield response to the various cover crops was also pronouced. At the Mountain Research Station (Figure 4), the rye cover crop no-till tobacco yielded much higher than the tobacco planted in the other cover residues. At this location, vetch cover residue resulted in the lowest tobacco yields. At the Buncombe Co. location, rye residue again gave the greatest response in no-till tobacco yields (Figure 5). The cultivated treatment (barley cover turned in late spring) yielded similarly, with the other residue covers slightly lower. Plots with no winter cover (bare) yielded the lowest poundage.

II. Graduate Students: None

III. Postdoctoral Fellows: None

IV. Publications:

1. Hoyt, G.D. 1983. Winter annual cover crops for no-till crop production. Soil Science Soc. North Carolina Proceedings 26:69-73.

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Source: https://www.industrydocuments.ucsf.edu/docs/jtyk0000

VI. Manuscripts in Review:

1. Hoyt, G.D. 1984. Cover Crops for no-till Vegetable and Tobacco Production. Soil Science Soc. North Carolina Proceedings 27:

VII. Papers Presented at Professional Meetings:

1. Cover Crops for no-till vegetable and tobacco production. G.D. Hoyt; Presented before Soil Science Society of North Carolina, Raleigh, January 1984.

2. Cover Crops for no-till vegetable and tobacco production. G.D. Hoyt; Presented before the Agronomy and Soil Conservation Divisions, Southern Association of Agricultural Scientists at Nashville, Tenn., February 1984.

VIII. Acknowledgements:

We appreciate the assistance and cooperation of the Mountain Research Station staff for help at that location, and Mr. Ormond Cole for work at the Buncombe County location.

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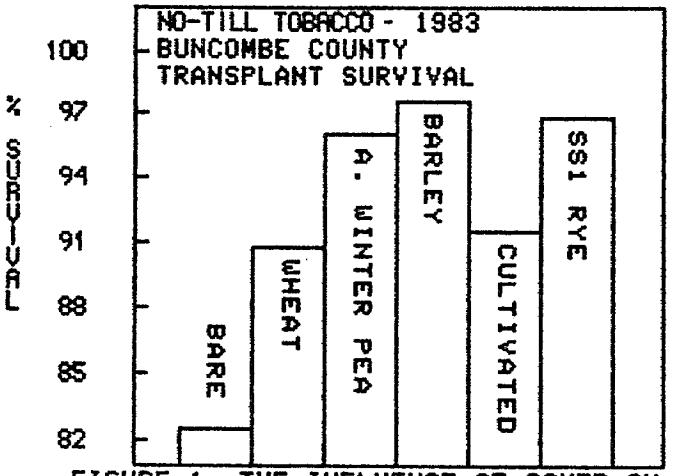

FIGURE 1. THE INFLUENCE OF COVER ON TRANSPLANT SURVIVAL

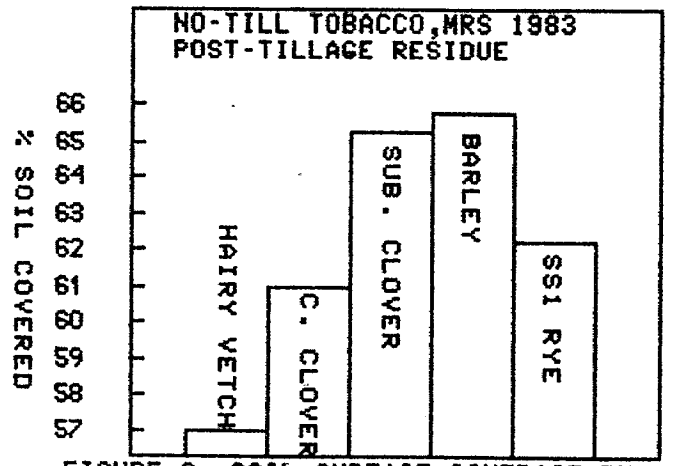

FIGURE 2. SOIL SURFACE COVERAGE BY VARIOUS RESIDUES

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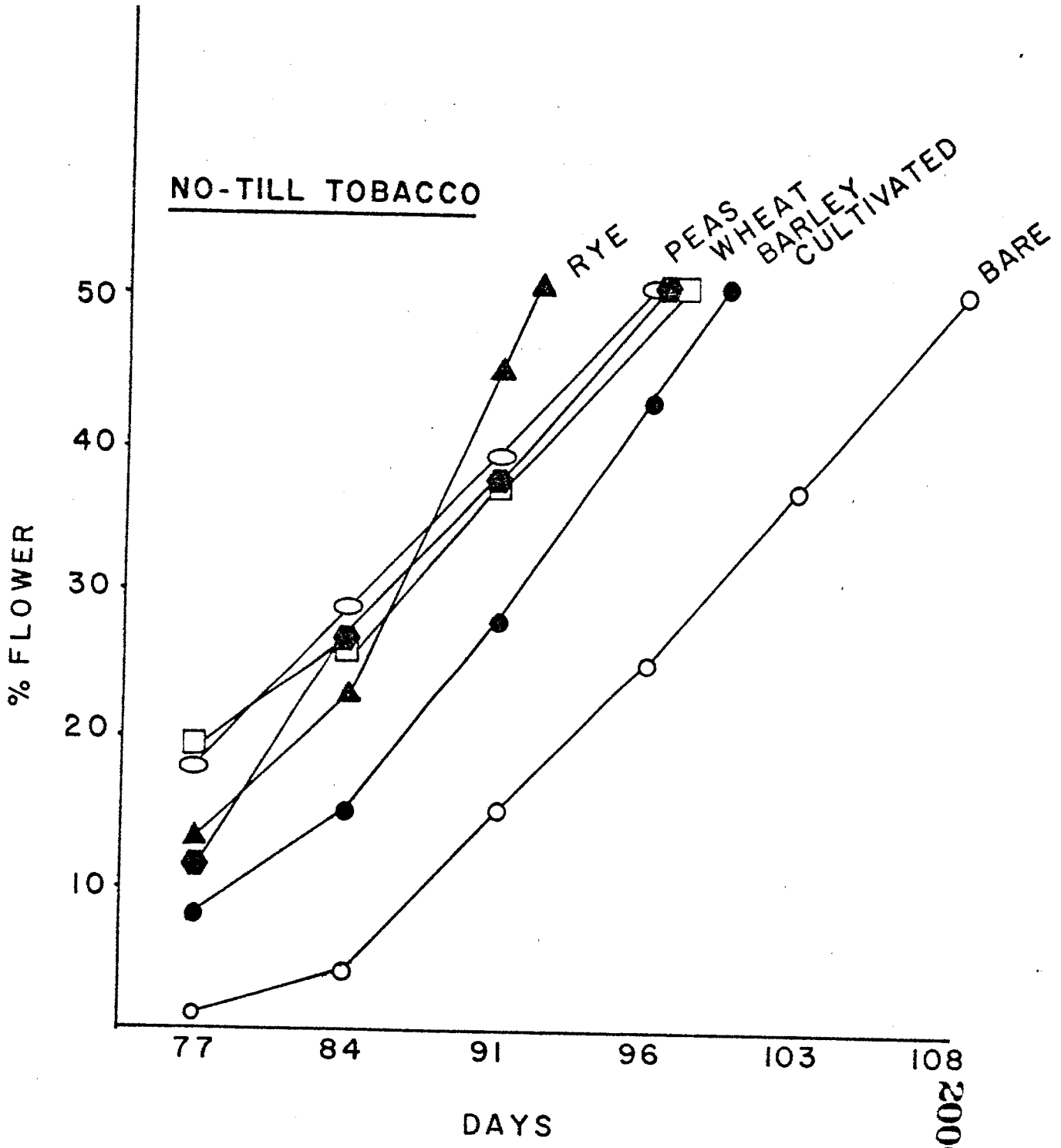

FIGURE 3. EFFECTS OF RESIDUE ON FLOWERING

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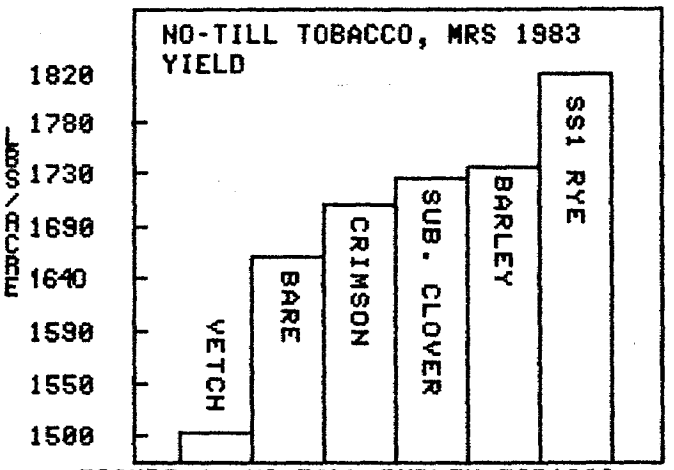

FIGURE 4. NO-TILL BURLEY TOBACCO YIELD, MTN. RES. STA.

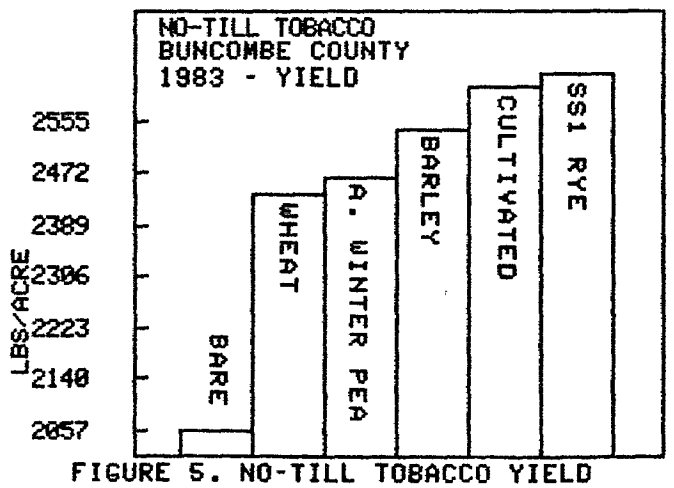

FIGURE 5. NO-TILL TOBACCO YIELD BUNCOMBE CO.

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TOBACCO LITERATURE SERVICE

Annual Report for the Calendar Year 1983

Personnel:	Director:	Carmen M. Marin
	Librarian:	Paul A. Suhr
	Secretary:	Carolyn Bridges
	Clerk-Typist:	Sue Blake

		1982	1983	Change
I.	TOBACCO ABSTRACTS.			
	Abstracts published	2,276	1,924	− 352
	Publications searched	6,901	5,837	−1,064
	Average per month	575	503	− 72
	Distribution			
	Domestic:(258)			
	Exchange	51	49	− 2
	Complimentary	173	106	− 67
	Subscriptions	109	103	− 6
	Foreign:(336)			
	Exchange	152	139	− 13
	Complimentary	27	28	+ 1
	Subscriptions	177	169	− 8
	Total	689	594	− 95
	Copies per year	4,140	3,564	− 576
II.	TOBACCO REPRINT SERIES.			
	Reprints published (#678-688)	30	11	− 19
	Recipients	168	162	− 6
	Copies distributed	5,040	1,782	−3,258
III.	BIBLIOGRAPHIC INFORMATION SERVICE.			
	Requests served	1,832	1,100	− 732
IV.	PHOTOCOPY SERVICE.			
	Tobacco Staff	7,520 p.	6,049 p.	−1,471 p.
	Paid orders	839 p.	1,072 p.	+ 233 p.

V. OTHER PUBLICATIONS DISTRIBUTED.

"Recent Advances in Tobacco Science".	79 copies
"Tobacco Reprint Series; 640 Publications by the Tobacco Staff, North Carolina State University 1954-1981" by Joseph A. Weybrew.	23 copies
"Theses on Tobacco. I. North Carolina State University. II. United States Universities" by Carmen M. Marin.	265 copies
"Tobacco Literature, a Bibliography" by Carmen M. Marin.	31 copies

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ADDENDUM

Listed below, by department, are research activities which received supplemental funding from the North Carolina Tobacco Foundation, Inc. for the period July 1, 1983 through June 30, 1984.

Activity	Investigator(s)
Biochemistry	
Development of Ripening Agents for Tobacco	E. C. Sisler
Biological and Agricultural Engineering	
Energy Reduction in Curing Tobacco	W. H. Johnson
Development of Fourier Transform NIR Instrumentation for Rapid Chemical Analyses of Tobacco	W. F. McClure and W. W. Weeks
Improved Efficiency in Wood Fired Curers	R. W. Watkins
Microcomputer Software for Flue-Cured Production Management Decisions	R. S. Sowell
Studies on Bulk Curing of Burley Tobacco	W. H. Johnson
Burley Mechanization	C. W. Suggs
Purchase a Tilrovator for the Lower Coastal Plain Tobacco Research Station	W. H. Johnson and S. C. Mohapatra
Botany	
Cytohistological and Ultrastructural Changes in Apical Meristem of Tobacco During the Transition to Flowering	J. F. Thomas
Molecular Studies of DNA in Dihaploid Plants Obtained by Pollen Culture of Nicotiana tabacum	J. P. Miksche S. S. Dhillon E. A. Wernsman
Crop Science	
Genetic Information in Reproductive and Non Reproductive Nuclei of Tobacco	E. A. Wernsman

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Activity	Investigator(s)
Crop Science (continued)	
Remobilization of Nitrogen During Growth and Senescense of Flue-Cured Tobacco	R. C. Long and R. J. Volk
Interspecific Hybridization in Nicotiana	S. M. Reed
No-till Tobacco Research	A. D. Worsham
An Investigation of Tobacco Leaf Chemistry in Relation to Flavor	D. A. Danehower
Anther Culture as a Source of Genetic Variability in Tobacco Improvement	E. A. Wernsman
Analysis of High Molecular Weight Lipids from Flue-Cured Tobacco	W. W. Weeks
Analytical Services on Experimental Tobacco	W. W. Weeks
Isozyme Patterns in Haploid and Double Haploid Populations of Tobacco	V. A. Sisson
Economics and Business	
Explanation of Size and Structure in Tobacco Farming	D. A. Sumner
Entomology	
Evaluation of the Role of Alate Aphids in Transmission of Potato Virus Y (PVY) and Substrate Formation of Sooty Mold	E. P. Lampert
Continued Development of Improved Sampling Methods for Insect Abundance in Tobacco	E. P. Lampert
The Use of Feeding Deterrent in Pest Management of Soil Insects in Tobacco	F. Gould
Test and Demonstration of Insect Management Practices for Burley Tobacco	E. P. Lampert and P. S. Southern
Influence of Individual Cuticular Components from Green Tobacco Leaves on Tobacco Budworm Oviposition	D. M. Jackson

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Activity	Investigator(s)
Pesticide Residue Research Laboratory	
Effect of Time of Spraying MH on Sucker Control and Free and Bound MH Residue	T. J. Sheets and H. Seltmann
Residue Studies with EBDC Fungicides on Flue-Cured Tobacco	T. J. Sheets
Purchase of a Modular Computer System	T. J. Sheets
Genetics	
Genetic Modification of Tobacco	D. F. Matzinger
Plant Pathology	
Epidemiology of the Blue Mold Disease of Flue-Cured Tobacco Caused by Peronospora tabacina	C. E. Main
Epidemiology of the Tobacco Black Shank Disease	H. D. Shew
Pathotypes, Survival of P. solanacearum in Soil, Crops and Weeds and Predisposition of Tobacco Plants to Granville Wilt by Nematodes	E. E. Echandi
Blue Mold Research in Puerto Rico	C. E. Main P. B. Shoemaker N. T. Powell
Control of Flue-Cured Tobacco Diseases by Means of Chemical Application, Crop Rotation, and/or Varietal Resistance	N. T. Powell
Alternative Fungicides and Strategies for Blue Mold Control on Burley Tobacco	P. B. Shoemaker
Transfer of Resistance Genes from Nicotiana repanda to Nicotiana tabacum by Protoplast Fusion	Margaret E. Daub
Research on Tobacco Viruses	G. V. Gooding, Jr.
Naturally Infested Fields of Granville Wilt Research	E. E. Echandi H. W. Spurr, Jr. G. R. Gwynn
Tobacco Blue Mold - Identification of Pathogenic Races	H. W. Spurr, Jr.

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Activity	Investigator(s)
Sociology and Anthropology	
Tobacco Farming as a Component of Agricultural Structure: Its Relationship with Social Well-Being	R. C. Wimberley
Soil Science	
The Role of Water Stress in Regulation of Photosynthesis Assimilate Partitioning and Root Growth of Tobacco	C. D. Raper, Jr.
Site-Specific Subsoil Requirements	G. S. Miner and M. J. Vepraskas
The Influence of Tillage and Cover Crop Management on Burley Tobacco Production	G. D. Hoyt
To Study the Effect of Excess Fertilization on Burley Tobacco Production, Quality and Fertilizer Efficiency	J. E. Shelton
General	
Graduate Research Assistants and Emergency Purchases	T. J. Mann

Please keep in mind that the information presented in this annual report is NOT FOR PUBLICATION but merely represents preliminary findings which may later appear in published form. We trust that you will find the information presented herein of interest and value.

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